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EXAMINER	
ROSARIO-VASQUEZ, DENNIS	
ART UNIT	**PAPER NUMBER**
2621	6

DATE MAILED: 01/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/664,937	FANG ET AL.	
	Examiner	Art Unit	
	Dennis Rosario-Vasquez	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _06 November 2003_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-20_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-20_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _September 19, 2000_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.

4) ☐ Interview Summary (PTO-413) Paper No(s). _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: .

DETAILED ACTION

Response to Amendment

1. Applicant's amendment was received on 03 November 2003, and has been entered and made of record. Currently, claims 1-20 are pending.

Specification

2. The amendment to the specification was reviewed and accepted.

Response to Arguments

3. Applicant's arguments filed 03 November 2003 have been fully considered but they are not persuasive for claims 1, 4, and 12.

With regard to claim 1, the amendment states at page 11, lines 4-7," Sundar does not teach determining a circle in a region of interest, much less, "determining the circle upon determining a connectivity of the first and second pair of edge points" as claimed in claim 1. Sundar does not teach determining a particular shape of the substrate." [Using figure 7, Sundar states," Since the substrate 140 is generally circular, however, the six data points 221-226 define a circle. The center 230 of the circle, and hence the center of the substrate 140, can be calculated from an appropriate formula (col. 9, lines 59-63)."]

Additionally, the amendment states at page 11, lines 9,10," Nowhere does Sundar teach determining the circle (Sundar states, "Another formula for calculating the center of the circle from points on the circle takes any two chords, such as chords 232 and 234, that connect any two data points, calculates the perpendicular bisectors 236,238, and calculates the intersection of the perpendicular bisectors. This intersection would be the center 230 of 140...if... 140 were a perfect circle (col. 10, lines 43-49).") upon determining a connectivity (Using figure 7, Sundar states," In order to reduce or eliminate the effects of unreliable data points, the distances from the center 230 to the data points of the chords are calculated, and if any of these distances is not within an acceptable tolerance of the radius of...140, then this center may be discarded as invalid or unreliable. Using only the valid centers from every possible set of two chords generated by every possible combination of data points, an average center may be calculated to give the final center coordinates (col. 10, lines 49-57).") of the first and second pair of edge points (The first and second pair of edge points were determined from the intersection of a chord on the circle's edge of data points) as claimed in claim 1."

With regard to claims 4 and 12, the amendment states at page 12, lines 13-15," Sundar does not teach or suggest "determining whether a local maximum along the gradients match the coordinates for any edge point"...".

However, Sundar does teach finding the center of a circle using valid data points (as a gradient or local maximum from multiple data points) on the edge of a circle for discarding invalid data points from the multiple data points on the edge of a circle (col. 10, lines 49-57).

Further, with regard to claims 4 and 12, the amendment states at page 12, lines 16-23, "Yamagata does not confirm whether the given image pixel is an edge pixel after determining the local maximum relative to the neighborhood. Yamagata does not teach "determining whether a local maximum along the gradients match the coordinates for any edge point (Using figure 2, Yamagata states," The circle edge detector 5 detects circle edge pixels by determining whether an image pixel that was determined to be an edge pixel [which previously was determined from a local maximum at col. 5, lines 15-17] is also a circle edge pixel. To do so, the circle edge detector 5 accesses the balance operator 9 to determine the intensity values (intensity values contain vector/coordinate values @ col. 4, lines 26-29) of the left and right side pixels relative to the image pixel being examined...(col. 5, lines 43-48)...")...Yamagata assumes a local maximum to be an edge point and does not teach a match of coordinates (Yamagata does teach a match of coordinates: "The circle detector 5 determines whether the image pixel being examined is a circle edge pixel when all three of the following conditions are satisfied:[Various intensity or gradient values (col. 5, lines 55-59) are compare to various thresholds (col. 6, lines 1-4).]...(col. 5, lines 65-67).")

Applicant's arguments, see amendment, page 11, lines 14-19, filed November 6, 2003, with respect to the rejection(s)of claim(s) 8 and 15 under Sundar et al. (U.S. Patent 6,198,976 B1) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Palmquist et al. (U.S. Patent 5,179,419).

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1 and 3 rejected under 35 U.S.C. 102(b) as being anticipated by Sundar (U.S. Patent 6,198,976 B1).

With regard to claim 1, Sundar et al. teaches a method for determining a circle in a region of interest comprising the steps of:

a) Extracting a first pair and a second pair of edge points from a region of interest. The region of interest in Sundar et al. is the substrate 140 in Figure 7. A first pair of edge points consists of data points 223 and 224 and the second pair of edge points consists of data points 222 and 225.

b) Determining an intersection of a first and second line extending perpendicular from a pair of midpoints of the first and second pair of edge points respectively. Sundar et al. calculates the perpendicular bisectors 236, 238 of figure 7, and calculates the intersection of the perpendicular bisectors at the center point 230.

c) Determining a radius from the intersection to any edge point. Sundar et al. states "...the distances [or radius] from the center 230 [of figure 7] to the data points of the chords are calculated...(see column 10, lines 50-54)."

e) Determining the circle upon determining a connectivity of the first pair and second pair of edge points (Using figure 7, Sundar states," In order to reduce or eliminate the effects of unreliable data points, the distances from the center 230 to the data points of the chords are calculated, and if any of these distances is not within an acceptable tolerance of the radius of...140, then this center may be discarded as invalid or unreliable. Using only the valid centers from every possible set of two chords generated by every possible combination of data points, an average center may be calculated to give the final center coordinates (col. 10, lines 49-57).") of the first and second pair of edge points (The first and second pair of edge points were determined from the intersection of the chords 234 and 232 on the circle's edge of data points 222, 223, 224, and 225) as claimed in claim 1.".

With regard to claim 3, Sundar uses a substrate center-finding system to find a circular substrate as the region of interest (see col. 4, line 51 and col. 5, line 22), and the circular substrate is the dominant feature or object utilized by the center-finding system to find certain characteristics of the circular substrate (see figure 7). Thus, the circle is the dominant feature as called for in claim 3.

6. Claims 8, 9,15,19, and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by Palmquist et al. (U.S. Patent 5,179,419 A)

With regard to claims 8 and 15, Palmquist et al. discloses a computer ("algorithm" @ col. 5, lines 10-16) method of a system for determining a circle in an image (Palmquist et al. states," A two-dimensional accumulator 69 (see FIG. 15), discretized to the resolution of the image and limited to a rectangle about the center of the image can be used to record the intersection points of the bisectors (col. 10, lines 52-55."), comprising the steps of:

a) extracting a first pair of edge points ("considering a large number of pairs of points on the boundary" @ col. 10 , lines 47,48) along an x-axis ("two-dimensional accumulator" @ col. 10, line 51) of the image;

b) extracting a second pair of edge points ("considering a large number of pairs of points on the boundary" @ col. 10 , lines 47,48) along an y-axis ("two-dimensional accumulator" @ col. 10, line 51) of the image; and

c) determining an intersection of a first and second line extending perpendicular from a pair of midpoints of the first and second pair of edge points respectively (Using figure 15, Palmquist et al. states,"...points on the boundary of the image...are used to compute the perpendicular bisectors 65-65 of the chords 66-66 (col.11, lines 7-9).").

With regard to claim 9, Palmquist et al. discloses a system of a method of claim 8, further comprising the step of determining a radius from the intersection to any edge point (Palmquist states,"...the distance from the center to each boundary point is calculated to determine the radius (col. 11, lines 48,49).").

With regard to claims 19 and 20, Palmquist et al. discloses a computer ("algorithm" @ col. 5, lines 10-16) system of a method of claims 8 and 15, further comprising, determining the circle upon determining a connectivity of the first and second pair of edge points (Palmquist et al. states," ...the distance from the center to each boundary point is calculated to determine the radius. The radius is set to correspond to that distance which occurs most often (col.11, lines 48-51).").

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 12,13,16, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Palmquist et al. as applied to claims 1, 8, and 15 above, and further in view of Yamagata (U.S. Patent 6,021,222 A).

With regard to claims 12 and 16, Palmquist et al. teaches a computer (Palmquist: "algorithm" @ col. 5, lines 10-16) system of a method of claims 1,8 and 15, further comprising the step of verifying the edge points comprising the steps of:

a) scanning the image along the x-axis (A gradient operator is performed in the x direction (Palmquist: col. 6, lines 65-68 and col. 7, line 1) of the region of interest (Palmquist: fig. 14, num. 31 is the region of interest after applying a mask 62).;

b) scanning the image along the y-axis (A gradient operator is performed in the y direction (Palmquist: col. 6, lines 65-68 and col. 7, line 1) of the region of interest;

c) performing a horizontal gradient and a vertical gradient along the x and y-axis of the region of interest respectively (Palmquist et al. states," A gradient function at each pixel is computed using gradient operators which generate estimates of the first derivative of the intensity function in horizontal and vertical, i.e., x and y, directions (col.6, lines 65-68 and col. 7, line 1).").

Palmquist does not teach the remaining portion of claims 12 and 16 of matching gradients with edge points, but does teach using gradients for focusing an image for subsequent determination of edge points (Palmquist: The section titled" Acquisition of Images Through Automatic Focusing and Multiple Image Fusion" @ col. 6, line 47). Also, using figure 11 Palmquist does analyze an intensity distribution using a threshold for isolating the object of interest using morphological opening to determine the center of the circle at a later step (col. 9, lines 52-61).

However, Yamagata does teach the remaining potion of claim 12 and 16 of determining whether a local maximum along the gradients match the coordinates for any edge point (Using figure 2, Yamagata states," The circle edge detector 5 detects circle edge pixels by determining whether an image pixel that was determined to be an edge pixel [which was determined from a local maximum at col. 5, lines 15-17] is also a circle edge pixel. To do so, the circle edge detector 5 accesses the balance operator 9 to determine the intensity values (intensity values contain vector/coordinate values @ col. 4, lines 26-29) of the left and right side pixels relative to the image pixel being examined...(col. 5, lines 43-48)..."). Additionally, (Yamagata states, "The circle detector 5 determines whether the image pixel being examined is a circle edge pixel when all three of the following conditions are satisfied: [Various intensity values (col. 5, lines 55-59) are compare to various thresholds (col. 6, lines 1-4).]...(col. 5, lines 65-67).")

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use Yamagata's teaching of using a balance operator that uses gradients with thresholds that determines whether an edge point is a circle edge point within Palmquist's fiber isolation procedure (figure 11) at the step of "HISTOGRAM-BASED THRESHOLDING" because Yamagata's teaching of using a gradient threshold with the balance operator will produce "An ideal or perfect circle image [which] does not have any extraneous or noisy images, and its background is at an intensity level of 0 (col. 6, lines 11-13)."

With regard to claims 13 and 17, the combination of Palmquist et al. and Yamagata teaches a computer ("algorithm" @ col. 5, lines 10-16) system of a method of claims 12 and 15, wherein the step of determining the match comprises the steps of:

a) Searching from each edge of the image (Yamagata states,"...the Sobel operator is applied in two orthogonal directions...(col. 4, lines 26,27)."), inward (Yamagata states,"...the Sobel operator uses the "east (right) and "south" (down) directions as the positive directions in a coordinate system (col. 4, lines 32-34).") to determine the local maximum (Yamagata states,"...the Sobel operator...calculate[s] the gradient vector...(M(x,y) (col.4, lines 22-25)." Sobel states," The given image pixel M(x,y) is determined to be a local maximum...(col.5, line 7); and

b) determining whether the local maximum matches the coordinates for any edge point (Yamagata states,"...the balance operator 9...[determines] how much the direction...of the edge pixel's gradient vector must be modified in order to balance the gradient vector towards the center of a hypothetical circle that includes the detected edge pixel [which was detected as a local maximum] (col. 5, lines 15-17, 20-24).")

9. Claims 2,10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sundar et al. and Palmquist et al. as applied to claims 1 and 8 above, and further in view of Huber (U.S. Patent 4,523,188).

With regard to claims 2 and 10, Sundar or Palmquist does not teach that the x-axis and the y-axis intersect within the circle using the method of claims 1 and 8.

The Sundar et al. reference finds the intersection of any 2 chords' perpendicular bisectors within a circle, and does not teach that the x-axis and the y-axis intersect within the circle for finding the intersection of the perpendicular bisector (see col. 10, lines 43-47).

However, Sundar et al. does mention any 2 chords within a circle can be used to find the perpendicular bisector; therefore the first chord can be horizontal and the second chord can be vertical.

Additionally, Palmquist et al. does uses x any y coordinates (col. 11, line 22), but does not show how the coordinate system is configured.

The Huber reference uses a coordinate system for finding the misalignment of the center of a circle with respect to the coordinate system's origin (see col. 1, lines 45-49). Additionally, Huber's coordinate system has an x and y-axis intersected within a circle as indicated within figures 1 and 2 (see col. 2, lines 44,45).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the coordinate system of Huber with Sundar's and Palmquist's circle to determine the position of each of the said horizontal and said vertical chords within Sundar's and Palmquist's circle using Huber's coordinate system to locate a spatial relationship of Sundar's and Palmquist's circle to other objects.

With regard to claim 11, the combination of Palmquist et al. and Huber discloses a system of the method of claim 10, wherein the image (figure 14 is a monitor display of an image) contains the whole circle (Figure 14 has a dashed outline or mask 66 retains the whole circle), and the circle being the dominant feature within the image (The monitor display shows a the circle 66 inscribing the object of interest with all other objects covered by mask 66).

10. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sundar et al. (U.S. Patent 6,198,976 B1)

Claim 7 requires a manual procedure for selecting the region of interest.

Sundar et al. teaches," Based on positional feedback…the controller can determine the…center of a substrate [or region of interest] (see col. 6, lines 31-35). ").

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the teachings Sundar et al., because if Sundar et al.'s automatic feedback procedure was removed, a manual procedure for finding the region of interest will be used by default. Moreover, a selection done by machine can obviously be done manually.

11. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sundar (U.S. Patent 6,198,976 B1) as applied to claim 1 above, and further in view of Yamagata (U.S. Patent 6,021,222 A).

With regard to claim 4 calls for the additional steps of:

a) Scanning the image along the x and y axis of the region of interest.

b) Performing a horizontal and vertical gradient along the x and y-axis of the region of interest.

c) Determining whether a local maximum along the gradients match the coordinates for any edge point.

The additional elements of claim 4 above are absent from the Sundar et al. reference, but it's clearly shown in the Yamagata reference. For instance, Yamagata teaches:

Scanning the image along the x and y axis of the region of interest. Yamagata explains "...two orthogonal directions...in a coordinate system describ[es] the scanned image (see column 4, lines 29-31)."

Performing a horizontal and vertical gradient along the x and y-axis of the region of interest. Yamagata states"...the Sobel operator...[calculates] the gradient vector...[and]... uses the "east" (right) and "south" (down) directions as the...directions in a coordinate system (see column 4, lines 22-23,32-34)." Note also Figure 5B where the "SOUTH" operator corresponds to the horizontal gradient and the "EAST" operator corresponds to the vertical gradient.

Determining whether a local maximum along the gradients match the coordinates for any edge point. Yamagata states "...if the difference in intensities is a local maximum.... then the given image pixel is considered an edge pixel (see column 5, lines 15-17)."

Note that Sundar et al. detects the edge points of a circular substrate using a "bank of sensors" which send trigger signals to the controller (see Sundar: col. 6, lines 24-28).

On the other hand, Yamagata detects the edge points of a circle using techniques of digital image processing whereby an image is first transformed into digital data to be processed by a digital computer (see Yamagata: col.1, lines 15 et seq.).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the edge detecting technique taught by Yamagata in Sundar's system by replacing the "bank of sensors" with digital image processing because Sundar already contemplates the use of digital processing to compute the center coordinate of a circle.

With regard to claim 5,which includes the additional step of searching from each edge of the region of interest inward, Yamagata states,"...the Sobel operator is applied in two orthogonal directions to the intensity values [of pixels]...(see col. 4, lines 26-29)." Note that the Sobel operator uses the "east"(right) and "south"(down) or "north"(up) and the "west" (left) as the orthogonal directions as inward directions of the region of interest or document (see col. 2, lines 44-45, col. 4, lines 30-31,42,43 and figure 5B).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the teachings of Yamagata to use the Sobel operator to define edge features of various shapes.

Allowable Subject Matter

12. Claims 6,14 and 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Claim 6 is allowable over the art of record for requiring that if a foreign structure is both inside and outside the circle, randomly scan at a plurality of points each axis of the region of interest within ½ of the total axis length and calculating a median value for each coordinate of the center of the circle. None of the art of record teaches or suggests this feature within a method as called for in claim 6 and its parent claims.

Claims 14 and 18 are allowable over the art of record for the same reasons as claim 6 above.

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Itsuzaki et al. (U.S. Patent 5,995,663) teaches a method to detect a shape using multiple windows for scanning.

De Queiroz et al. (U.S. Patent 5,892,854) teaches a method to detect a shape within an image using binary moments and a bounding rectangle.

Tsuboi et al. (U.S. Patent 5,825,914) teaches a method to find the center of objects using an ellipse approximation to find the edges and a histogram for finding the center.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dennis Rosario-Vasquez whose telephone number is 703-305-5431. The examiner can normally be reached Monday thru Friday from 9AM to 5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Boudreau, can be reached on (703) 305-4706. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9314 for regular communication and 703-872-9313 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed customer service whose telephone number is 703-306-0377.

DRV

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